



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

10/667,152

09/16/2003

Andrew Lines

FULCP006

8727

22434

7590

04/20/2006

BEYER WEAVER & THOMAS LLP

P.O. BOX 70250

OAKLAND, CA 94612-0250

EXAMINER

LI, AIMEE J

ART UNIT

PAPER NUMBER

2183

DATE MAILED: 04/20/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.		Applicant(s)	
	10/667,152		LINES ET AL.	
	Examiner		Art Unit	
	Aimee J. Li		2183	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 September 2003 and 20 January 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-49 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-49 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>20 January 2004</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. Claims 1-49 have been considered.

Papers Submitted

2. It is hereby acknowledged that the following papers have been received and placed of record in the file: Specification and Drawings filed 19 September 2003; Oath and Declaration filed 20 January 2004; IDS filed 20 January 2004; and Miscellaneous Letter Requesting Status filed 25 March 2005.

Claim Objections

3. Claims 14 and 21 are objected to because of the following informalities: Please change claims 14 and 21, line 1 "wherein the circuit" to recite --where the asynchronous circuit-- to more clearly distinguish that "the circuit" being referred to is "the asynchronous circuit" not the "interface circuitry". Appropriate correction is required.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. Claims 23-26 and 45-48 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. The specification mentions in a total of three sentences on page 16, paragraph 0050 implementing the device in simulatable representation. However, there are hundreds of methods and ways to implement the

Art Unit: 2183

current circuit and system within software in a simulator with netlists and hardware description language. Without a specific description of how the circuit and system is to be implemented within software in a simulator, a person of ordinary skill in the art would require an extraordinary amount of undue experimentation to correctly implement the circuit and device via these specific methods, e.g. within a software simulator with netlists and/or HDL.

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 15 and 16 recite the limitation "the higher order" and "the lower order" in claims 15 and 16, lines 2-3. There is insufficient antecedent basis for this limitation in the claim.

8. Claim 27 recites the limitation "the circuit" in claim 27, line 2. There is insufficient antecedent basis for this limitation in the claim. Claim 27 is an independent claim and "the circuit" has not been established prior to the incorporation of claim 1.

9. Claim 31 recites the limitation "the at least one optional assign" in claim 31, line 4. There is insufficient antecedent basis for this limitation in the claim.

10. Claim 49 recites the limitation "the system" in claim 49, line 2. There is insufficient antecedent basis for this limitation in the claim. Claim 49 is an independent claim and "the system" has not been established prior to the incorporation of claim 1.

Claim Rejections - 35 USC § 102

11. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

12. Claims 1-14, 20, 22, 27-32, 34-35, 37-42, 44, and 49 are rejected under 35 U.S.C. 102(b) as being taught by Vegesna et al., U.S. Patent Number 5,488,729 (herein referred to as Vegesna).

13. Referring to claims 1, 22, and 27, taking claim 1 as exemplary, Vegesna has taught an asynchronous circuit for processing units of data having a program order associated therewith (Vegesna column 8, lines 17-26), the circuit comprising

- a. An N-way-issue resource comprising N parallel pipelines (Vegesna column 7, lines 13-28; Figure 2; column 8, lines 27-37; column 12, line 55 to column 13, line 15; Figure 13; column 15, lines 11-23; Figure 15; column 19, lines 58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; and Figure 24), each pipeline being operable to transmit a subset of the units of data in a first-in first-out manner (Vegesna column 7, lines 13-28; Figure 2; column 8, lines 17-37; column 12, line 55 to column 13, line 15; Figure 13; column 14, lines 53-61; Figure 14(b); column 15, lines 11-23; and Figure 15),
- b. Wherein the asynchronous circuit is operable to sequentially control transmission of the units of data in the pipelines such that the program order is maintained (Vegesna column 7, lines 13-28; Figure 2; column 8, lines 17-37; column 12, line 55 to column 13, line 15; Figure 13; column 14, lines 53-61; Figure 14(b); column 15, lines 11-23 and 43-54; and Figure 15).

14. Claims 22 and 27 are substantially similar to claim 1 and rejection for the same reasons above. The only differences being that claim 22 is a computer-readable medium having data structures stored therein representative of claim 1 and claim 27 is a set of semiconductor processing masks.

15. Referring to claim 2, Vegesna has taught wherein the circuit comprises a processor (Vegesna column 1, lines 13-36) and wherein the N-way-issue resource comprises an instruction pipeline (Vegesna column 7, lines 13-28; Figure 2; column 8, lines 27-37; column 12, line 55 to column 13, line 15; Figure 13; column 14, lines 53-61; Figure 14(b); column 15, lines 11-23; Figure 15; column 19, lines 58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; and Figure 24).

16. Referring to claim 3, Vegesna has taught wherein N comprises an integer greater than 1 (Vegesna column 7, lines 13-28; Figure 2; column 8, lines 27-37; column 12, line 55 to column 13, line 15; Figure 13; column 15, lines 11-23; Figure 15; column 19, lines 58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; and Figure 24).

17. Referring to claim 4, Vegesna has taught an M-way-issue resource (Vegesna column 19, lines 58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; column 27, line 33 to column 29, line 5; and Figure 24), and interface circuitry operable to facilitate communication between the N-way-issue resource and the M-way-issue resource (Vegesna column 26, lines 3-49; column 27, line 33 to column 29, line 5; and Figure 24).

18. Referring to claim 5, Vegesna has taught wherein M is fewer than N (Vegesna column 19, lines 58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; column 27, line 33 to column 29, line 5; and Figure 24).

19. Referring to claim 6, Vegesna has taught wherein M is 1 and N is 2 (Vegesna column 19, lines 58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; column 27, line 33 to column 29, line 5; and Figure 24).

20. Referring to claim 7, Vegesna has taught wherein M is greater than N (Vegesna column

19, lines 58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; column 27, line 33 to column 29, line 5; and Figure 24).

21. Referring to claim 8, Vegesna has taught wherein M is 4 and N is 2 (Vegesna column 19, lines 58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; column 27, line 33 to column 29, line 5; and Figure 24).

22. Referring to claim 9, Vegesna has taught wherein the interface circuitry is operable to facilitate transmission of selected ones of the data units from the N-way-issue resource to the M-way issue resource (Vegesna column 19, lines 58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; column 27, line 33 to column 29, line 5; and Figure 24).

23. Referring to claim 10, Vegesna has taught wherein the interface circuitry is operable to facilitate transmission of selected ones of the data units from the M-way-issue resource to the N-way issue resource (Vegesna column 19, lines 58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; column 27, line 33 to column 29, line 5; and Figure 24).

24. Referring to claim 11, Vegesna has taught wherein the interface circuitry is operable to facilitate transmission of first selected ones of the data units from the N-way-issue resource to the M way-issue resource, and second selected ones of the data units from the M-way-issue resource to the N-way-issue resource (Vegesna column 19, lines 58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; column 27, line 33 to column 29, line 5; and Figure 24).

25. Referring to claim 12, Vegesna has taught wherein there is a one-to-one correspondence between the first and second selected data units (Vegesna column 19, lines 58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; column 27, line 33 to column 29, line 5; and Figure 24).

Art Unit: 2183

26. Referring to claim 13, Vegesna has taught wherein there is not a one-to-one correspondence between the first and second selected data units (Vegesna column 19, lines 58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; column 27, line 33 to column 29, line 5; and Figure 24).

27. Referring to claim 14, Vegesna has taught wherein the circuit comprises a processor and wherein each of the N-way-issue resource and the M-way-issue resource comprises one of an instruction dispatcher, a register file, an instruction cache, a branch predictor, an instruction fetch circuit, a writeback circuit, an instruction decoding circuit, an execution pipeline, and branch circuitry (Vegesna column 19, lines 58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; column 27, line 33 to column 29, line 5; and Figure 24).

28. Referring to claim 20, Vegesna has taught wherein each pipeline comprises a plurality of stages, corresponding stages in each pipeline being interconnected in a state loop operable to communicate state information among the pipeline stages (Vegesna column 7, lines 13-28; Figure 2; column 8, lines 27-37; column 12, line 55 to column 13, line 15; Figure 13; column 14, lines 53-61; Figure 14(b); column 15, lines 11-23; Figure 15; column 19, lines 58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; and Figure 24).

29. Referring to claims 28, 44, and 49, Vegesna has taught a heterogeneous system for processing units of data having a program order associated therewith (Vegesna column 8, lines 17-26), the system comprising

- a. An N-way issue resource and at least one multiple-issue resource having an order different from N (Vegesna column 19, lines 58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; column 27, line 33 to column 29, line 5; and Figure

24),

- b. The system further comprising interface circuitry operable to facilitate communication between the N-way-issue resource and the at least one multiple-issue resource (Vegesna column 26, lines 3-49; column 27, line 33 to column 29, line 5; and Figure 24) and to preserve the program order in all of the resources (Vegesna column 7, lines 13-28; Figure 2; column 8, lines 17-37; column 12, line 55 to column 13, line 15; Figure 13; column 14, lines 53-61; Figure 14(b); column 15, lines 11-23 and 43-54; and Figure 15).

30. Claims 44 and 49 are substantially similar to claim 28 and rejection for the same reasons above. The only differences being that claim 44 is a computer-readable medium having data structures stored therein representative of claim 28 and claim 49 is a set of semiconductor processing masks.

31. Referring to claim 29, Vegesna has taught wherein the at least one multiple-issue resource comprises a plurality of multiple-issue resources having different orders (Vegesna column 19, lines 58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; column 27, line 33 to column 29, line 5; and Figure 24).

32. Referring to claim 30, Vegesna has taught wherein the interface circuitry comprises a dispatch circuit operable to route the data units received from the N-way issue resource on a first number of input channels to designated ones of a second number of output channels associated with the at least one multiple-issue resource in a deterministic manner thereby preserving a partial ordering for each output channel defined by the program order (Vegesna column 19, lines

Art Unit: 2183

58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; column 27, line 33 to column 29, line 5; and Figure 24).

33. Referring to claim 31, Vegesna has taught wherein the N-way issue resource comprises first and second pipelines (Vegesna column 7, lines 13-28; Figure 2; column 8, lines 27-37; column 12, line 55 to column 13, line 15; Figure 13; column 15, lines 11-23; Figure 15; column 19, lines 58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; and Figure 24), and the interface circuitry comprises a dual filter comprising a dual-issue input datapath corresponding to the first and second pipelines, a single-issue output datapath, and a control channel, the at least one optional assign being operable to selectively transmit data tokens on the input datapath to the output datapath according to control information on the control channel (Vegesna column 19, lines 58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; column 27, line 33 to column 29, line 5; and Figure 24).

34. Referring to claim 32, Vegesna has taught wherein the interface circuitry comprises remapping circuitry operable to route the data units received from the at least one multiple-issue resource on a first number of input channels to designated ones of a second number of output channels associated with the N-way issue resource in a manner which preserves the program order (Vegesna column 19, lines 58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; column 27, line 33 to column 29, line 5; and Figure 24).

35. Referring to claim 34, Vegesna has taught wherein the at least one multiple-issue resource comprises an M-way issue resource where M is an integer multiple of N (Vegesna column 19, lines 58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; column 27, line 33 to column 29, line 5; and Figure 24), and wherein the interface circuitry comprises a plurality

of split circuits which operate alternately to transmit the data units from the N-way issue resource to the M-way issue resource, and a plurality of merge circuits which operate alternately to transmit the data units from the M-way issue resource to the N-way issue resource (Vegesna column 31, line 58 to column 33, line 35; Figure 19; Figure 27; and Figure 28).

36. Referring to claim 35, Vegesna has taught wherein the at least one multiple-issue resource comprises an M-way issue resource where M is less than N (Vegesna column 19, lines 58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; column 27, line 33 to column 29, line 5; and Figure 24), and wherein the interface circuitry comprises at least one optional assign circuit which is operable to receive the data units from both of the N-way issue resource and M-way issue resource and to selectively transmit the received data units back into the N-way issue resource, thereby mitigating effects of a difference in throughput between the N-way issue resource and the M-way issue resource. (Vegesna column 19, lines 58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; column 27, line 33 to column 29, line 5; and Figure 24).

37. Referring to claim 37, Vegesna has taught wherein the at least one optional assign comprises first and second input datapaths, an output datapath, and a control input, the at least one optional assign being operable to transmit a first data token on the first input datapath to the output datapath when the control input is in a first state, the at least one optional assign further being operable to discard the first data token and to transmit a second data token on the second input datapath to the output datapath when the control input is in a second state (Vegesna column 19, lines 58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; column 27, line 33 to column 29, line 5; and Figure 24).

38. Referring to claim 38, Vegesna has taught wherein the at least one optional assign further being operable to discard the second data token and to transmit the first data token to the output datapath when the control input is in a third state (Vegesna column 19, lines 58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; column 27, line 33 to column 29, line 5; and Figure 24).

39. Referring to claim 39, Vegesna has taught wherein the interface circuitry comprises a dual repeat circuit comprising a single-issue data input channel, a dual-issue data output channel, and a control channel, the dual repeat circuit being operable in response to control information on the control channel to transmit a first data token on the input channel to the output channel and to maintain the first data token on the input channel for future use, the dual repeat circuit also being operable in response to the control information to transmit a second data token on the input channel to the output channel and to discard the second data token so that the input channel can receive subsequent data token (Vegesna column 19, lines 58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; column 27, line 33 to column 29, line 5; and Figure 24).

40. Referring to claim 40, Vegesna has taught wherein the N-way issue resource has N pipelines associated therewith, and wherein the at least one multiple-issue resource has P pipelines associated therewith, and wherein N may be any of fewer than P, equal to P, or greater than P (Vegesna column 7, lines 13-28; Figure 2; column 8, lines 27-37; column 12, line 55 to column 13, line 15; Figure 13; column 15, lines 11-23; Figure 15; column 19, lines 58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; and Figure 24).

41. Referring to claim 41, Vegesna has taught wherein there is a one-to-one correspondence between the data units in the N-way issue resource and the data units in the at least one multiple-

Art Unit: 2183

issue resource (Vegesna column 19, lines 58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; column 27, line 33 to column 29, line 5; and Figure 24).

42. Referring to claim 42, Vegesna has taught wherein, at any given time, more of the data units are in the N-way issue resource than the at least one multiple-issue resource (Vegesna column 19, lines 58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; column 27, line 33 to column 29, line 5; and Figure 24).

Claim Rejections - 35 USC § 103

43. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

44. Claims 15-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vegesna et al., U.S. Patent Number 5,488,729 (herein referred to as Vegesna), as applied to claims 1 and 4 above, and in view of Hinton et al., U.S. Patent Number 5,428,811 (herein referred to as Hinton). Vegesna has not taught

- a. Wherein the interface circuitry is operable to identify selected ones of the data units in the higher order one of the resources for transmission to the lower order one of the resources (Applicant's claim 15).
- b. Wherein the interface circuitry is operable to transmit selected ones of the data units generated by the lower order issue one of the resources to the higher order issue one of the resources in such a way as to facilitate preservation of the program order (Applicant's claim 16).

- c. Wherein each pipeline is operable to transmit the units of data in accordance with an asynchronous handshake protocol (Applicant's claim 17).
- d. Wherein the asynchronous handshake protocol between a sender and a receiver in each of the pipelines comprises (Applicant's claim 18):
 - i. The sender sets a data signal valid when an enable signal from the receiver goes high (Applicant's claim 18);
 - ii. The receiver lowers the enable signal upon receiving the valid data signal (Applicant's claim 18);
 - iii. The sender sets the data signal neutral upon receiving the low enable signal (Applicant's claim 18); and
 - iv. The receiver raises the enable signal upon receiving the neutral data signal (Applicant's claim 19).
- e. Wherein the handshake protocol is delay-insensitive (Applicant's claim 19).

45. However, Vegesna has taught a multi-functional unit approach, dividing the functional units according to the number of cycles needed to complete an operation (Vegesna column 12, line 55 to column 13, line 15; Figure 13; column 14, lines 53-61; column 15, lines 11-22; and Figure 15). Hinton has taught a multi-functional unit, dividing the functional units according to the number of cycles needed to complete an operation (Hinton column 4, lines 15-29)

- a. Wherein the interface circuitry is operable to identify selected ones of the data units in the higher order one of the resources for transmission to the lower order one of the resources (Applicant's claim 15) (Hinton Abstract; column 4, lines 8-

- 29; column 5, line 21 to column 6, line 64; column 7, lines 33-54; column 8, line 55 to column 10, line 28; Figure 1; and Figure 3).
- b. Wherein the interface circuitry is operable to transmit selected ones of the data units generated by the lower order issue one of the resources to the higher order issue one of the resources in such a way as to facilitate preservation of the program order (Applicant's claim 16) (Hinton Abstract; column 4, lines 8-29; column 5, line 21 to column 6, line 64; column 7, lines 33-54; column 8, line 55 to column 10, line 28; Figure 1; and Figure 3).
- c. Wherein each pipeline is operable to transmit the units of data in accordance with an asynchronous handshake protocol (Applicant's claim 17) (Hinton Abstract; column 4, lines 8-29; column 5, line 21 to column 6, line 64; column 7, lines 33-54; column 8, line 55 to column 10, line 28; Figure 1; and Figure 3).
- d. Wherein the asynchronous handshake protocol between a sender and a receiver in each of the pipelines comprises (Applicant's claim 18):
- i. The sender sets a data signal valid when an enable signal from the receiver goes high (Applicant's claim 18) (Hinton Abstract; column 4, lines 8-29; column 5, line 21 to column 6, line 64; column 7, lines 33-54; column 8, line 55 to column 10, line 28; Figure 1; and Figure 3);
 - ii. The receiver lowers the enable signal upon receiving the valid data signal (Applicant's claim 18) (Hinton Abstract; column 4, lines 8-29; column 5, line 21 to column 6, line 64; column 7, lines 33-54; column 8, line 55 to column 10, line 28; Figure 1; and Figure 3);

- iii. The sender sets the data signal neutral upon receiving the low enable signal (Applicant's claim 18) (Hinton Abstract; column 4, lines 8-29; column 5, line 21 to column 6, line 64; column 7, lines 33-54; column 8, line 55 to column 10, line 28; Figure 1; and Figure 3); and
 - iv. The receiver raises the enable signal upon receiving the neutral data signal (Applicant's claim 19) (Hinton Abstract; column 4, lines 8-29; column 5, line 21 to column 6, line 64; column 7, lines 33-54; column 8, line 55 to column 10, line 28; Figure 1; and Figure 3).
- e. Wherein the handshake protocol is delay-insensitive (Applicant's claim 19) (Hinton Abstract; column 4, lines 8-29; column 5, line 21 to column 6, line 64; column 7, lines 33-54; column 8, line 55 to column 10, line 28; Figure 1; and Figure 3).

46. A person of ordinary skill in the art at the time the invention was made would have recognized that the protocol of Hinton ensures that all data and register space necessary for an instruction to be executed and completed is available, thereby ensuring that an instruction can properly execute prior to issuing the instruction to the execution units. Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to incorporate the handshake protocol of Hinton in the device of Vegesna to ensure an instruction can properly be executed before issuing the instruction to the execution units.

47. Claims 21 and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vegesna et al., U.S. Patent Number 5,488,729 (herein referred to as Vegesna), as applied to claim 1 above, and in view of Ahlgren et al.'s "SiGe Comes of Age in the Semiconductor

Art Unit: 2183

Industry” ©08 July 2002 (herein referred to as Ahlgren). Vegesna has not taught wherein the circuit or the system comprises any of a CMOS integrated circuit, a GaAs integrated circuit, and a SiGe integrated circuit. Ahlgren has taught the circuit or the system comprises any of a CMOS integrated circuit, a GaAs integrated circuit, and a SiGe integrated circuit (Ahlgren page 1, “Technology Overview”). A person of ordinary skill in the art at the time the invention was made, and as recognized by Ahlgren, would have recognized CMOS circuits more efficiently use power, GaAs circuits improves performance by boosting switching speed, and SiGe circuits provides a performance boost as well. Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to incorporate the CMOS, GaAs, and SiGe circuits of Ahlgren for power consumption efficiency and performance boosts.

48. Claims 23-26 and 45-48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vegesna et al., U.S. Patent Number 5,488,729 (herein referred to as Vegesna), as applied to claim 1 above, and in view of Bauer et al.’s “A Reconfigurable Logic Machine for Fast Event-Driven Simulation” ©1998 (herein referred to as Bauer). Vegesna has not taught

- a. Wherein the data structures comprise a simulatable representation of the circuit or system (Applicant’s claims 23 and 45).
- b. Wherein the simulatable representation comprises a netlist (Applicant’s claims 24 and 46).
- c. Wherein the data structures comprise a code description of the circuit (Applicant’s claims 25 and 47).
- d. Wherein the code description corresponds to a hardware description language (Applicant’s claims 26 and 48).

49. Bauer has taught

- a. Wherein the data structures comprise a simulatable representation of the circuit or system (Applicant's claims 23 and 45) (Bauer Abstract and Introduction, paragraphs 1-2 and 6).
- b. Wherein the simulatable representation comprises a netlist (Applicant's claims 24 and 46) (Bauer Abstract; Netlist Generation, paragraph 1).
- c. Wherein the data structures comprise a code description of the circuit (Applicant's claims 25 and 47) (Bauer Abstract and Introduction, paragraphs 1-2 and 6).
- d. Wherein the code description corresponds to a hardware description language (Applicant's claims 26 and 48) (Bauer Abstract and Introduction, paragraphs 1-2 and 6).

50. A person of ordinary skill in the art at the time the invention was made and as taught by Bauer, would have recognized that the simulation system of Bauer increases the speed of event-driven behavioral simulation (Bauer Abstract). Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to incorporate the simulator of Bauer in the device of Vegesna to increase simulator speed.

51. Claims 33 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vegesna et al., U.S. Patent Number 5,488,729 (herein referred to as Vegesna), as applied to claim 35 above, and in view of Murase et al., U.S. Patent Number 5,832,303 (herein referred to as Murase). Vegesna has taught

- a. Wherein the remapping circuitry comprises a circuit which is controlled by

routing information generated when the data units are transmitted from the N-way issue resource to the at least one multiple-issue resource (Applicant's claim 33) (Vegesna column 19, lines 58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; column 27, line 33 to column 29, line 5; and Figure 24).

- b. Wherein the interface circuitry further comprises a circuit by which the data units are transmitted from the M-way issue resource to the at least one optional assign circuit (Applicant's claim 36) (Vegesna column 19, lines 58-62; Figure 18; column 23, lines 8-42; column 26, lines 3-49; column 27, line 33 to column 29, line 5; and Figure 24).

52. Vegesna has not taught the circuit is a crossbar circuit. Murase has taught a crossbar circuit (Murase column 1, lines 50-61; column 2, lines 29-45; column 2, line 66 to column 3, line 18; Figure 1; column 6, lines 20-51; and Figure 5). A person of ordinary skill in the art at the time the invention was made, and as taught by Murase, would have recognized that the crossbar switch reduces the number of signal lines while performing at higher speeds (Murase column 1, lines 50-54). Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to incorporate the crossbar of Murase in the device of Vegesna to perform high-speed interconnection switches while reducing the number of signal lines.

Conclusion

53. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure as follows. Applicant is reminded that in amending in response to a rejection of claims, the patentable novelty must be clearly shown in view of the state of the art disclosed by

the references cited and the objections made. Applicant must also show how the amendments avoid such references and objections. See 37 CFR § 1.111(c).

- a. Vegesna et al., U.S. Patent Number 5,884,060, has taught a superscalar device with scheduling logic, e.g. N-way issuing.
- b. Jouppi, U.S. Patent Number 6,167,503, has taught a superscalar device with execution clusters and scheduling logic, e.g. N-way and M-way issuing.
- c. Prof. Wolfgang J. Paul's "Design and Evaluation of a RISC Processor with a Tomasulo Scheduler" has taught an out-of-order scheduler, e.g. N-way and M-way issuing, with a reorder buffer to ensure in-order instruction completion.

54. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Aimee J. Li whose telephone number is (571) 272-4169. The examiner can normally be reached on M-T 7:30am-5:00pm.

55. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Chan can be reached on (571) 272-4162. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

56. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Application/Control Number: 10/667,152


Page 20

Art Unit: 2183

AJL

Aimee J. Li

06 April 2006



EDDIE CHAN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2100